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(54) Title: MINERAL SALT PREPARATION AND METHOD OF PRODUCING SAME

(57) Abstract

A mineral salt composition, suitable for use as an additive for food or nutrients or as a medicament for the cure or prevention of deficiency diseases is produced by controlled evaporation of sea water, fractionated precipitation of crystalline sodium chloride and recovering the remaining dissolved mineral salts from the mother lye.

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MINERAL SALT PREPARATION AND METHOD OF PRODUCING SAME

The invention relates to a mineral salt composition for use as an additive for food or nutrients or as a medicament. The invention further relates to a method of producing the mineral salt composition from sea water.

5 While, in ancient time, substantially untreated and naturally occurring nutrients were used as food for man, people in the industrialized world are now, to an increasing extent, using refined food, the nutritional value of which is reduced because vitamins and minerals have been more or less
10 removed or deteriorated during refining processes or other treatments. The consequence of this can be faulty nutrition and deficiency diseases.

In recent time, it has been proved that many minerals are essential components of the food because they act as co-
15 enzymes in combination with many enzymes. In some cases the cations from mineral salts form complex compounds with certain enzymes. These so-called metallo-enzymes exist in an active and an inactive state, depending on different control mechanisms that regulate the complex formation. In order to
20 secure satisfactory function of these processes, said compounds must be present in optimal concentration intervals. Many of these compounds are found in very low concentrations and therefore they are often called trace elements.

Examples of essential trace elements are V, Cr, Mn, Co,
25 Cu, Zn, As, Mo and Se, the activity of which is known, but many other elements may be and probably are essential.

The risk of deficiency diseases due to low content of trace elements in the food is tried eliminated by supply of minerals to the organism as food supplement. Thus, in DK-
30 507/73 is disclosed a preparation containing 0,1 - 0,0001 % of several trace elements.

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In this way it is difficult, however, to secure optimal supply of all trace elements. Partly, the correct optimal concentrations of all elements are hardly known, and partly it is difficult to dose exact amounts of minerals in very 5 low concentrations. Further, an excessive amount of certain elements might expel other trace elements or block the activity of these. An excess of Cd or Ca will, for example, cause deficiency of Zn, excess of Mn will block for Mg, and excess of Zn or Mo may counteract Cu.

10 In order to obtain a desired taste or increase stability, large amounts of salt as pure sodium chloride are often added to the food. Certain nutrients, such as fish products is often preserved in salt brine, the main constituent of which is pure sodium chloride.

15 Further, it is common practice, during consumption of food and in order to obtain a desired taste, to add table salt to the food.

In this way, many people consume a larger amount of salt than needed for covering their natural requirement. 20 The excess of salt must be secreted from the organism through the kidneys, which might thus be overloaded. Further, a too high salt intake might change the natural electrolyte balance of the organism, which might have serious consequences for the health. A frequent result of exaggerated salt intake is hypertension and circulation diseases, 25 such as arteriosclerosis, brain haemorrhage and blood clots. Prolonged salt intake is also under suspicion as a cause for stomach cancer.

The electrolyte balance, that secures a correct electrical potential over the cell membranes, is primarily determined by the concentrations of sodium, potassium and magnesium ions. The normal concentrations of these cations, 30 expressed in meqv/l, is shown in the following table:

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T A B L E

Cation	Blood- serum	Intracellular Erythrocyte	liquid in Muscle cell
Na ⁺	142	30	5
K ⁺	5 - 5,5	128	150
Mg ⁺⁺	3 - 3,5	6	40

Due to the concentration differences between the intracellular and extracellular liquids the electrical potential over the cell membrane is about 60 mV for erythrocytes and 10 connective tissue and 90 - 120 mV for muscle tissue. Persons having low metabolism or other abnormal conditions can have other ion concentrations and substantially lower membrane potentials than the above mentioned. Such conditions are often accompanied with abnormal high content of liquid in 15 the tissues, resulting in edema.

The risk connected with consumption of large amount of salt as pure sodium chloride has been known for a long time, and for that reason it has been proposed to use salt mixtures containing substantial amounts of sodium, magnesium and 20 calcium salts. Thus, USP 1 998 179 suggests that an optimal physiologically balanced salt mixture contains Na, K, Ca and Mg in a molecular proportion of about 100:5:2,5:2,5.

The use of this known salt mixture will only solve the problem of maintaining the electrolyte balance, which gives 25 a correct potential over the cell membrane. On the other hand, no trace element is supplied, and the optimal amounts of trace elements can not be secured by supplement of known food additives containing trace elements. As mentioned above, it is practically difficult to dose trace elements 30 correctly in very small amounts, and further, the required amounts of trace elements also depend on the total amount of supplied salt.

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Even when using a salt mixture containing Na, K and Mg in optimal concentrations, a tendency to overdosing the salt intake still exists. When the kidneys secrete this excess, 5 in amounts proportional to the secreted salt.

The object of the present invention is to provide for a mineral salt composition that supplies Na, K, Ca and Mg in optimal amounts and also secures supply of all trace elements in the correct balanced proportion as needed by the organism.

10 Another object of the invention is to provide a simple and economic method of manufacturing this mineral salt composition.

15 The mineral salt composition in accordance with the invention is characterized by a content of soluble mineral salts in substantially the same relative proportion as found in sea water, except for a reduced amount of sodium chloride.

20 The composition can take form of a freely flowing powder or a granulate, suitable as a table salt. Instead, the composition can be compressed to tablets containing unit doses as a food additive or medicament.

25 The method of the invention is characterized in that sea water is evaporated until a substantial amount of sodium chloride is precipitated, after which the mother lye is isolated and, if desired, evaporated and dried. The evaporation and drying processes can be performed in any way known per se. The preferred methods are spray drying and drum drying, however.

30 As starting material for the method of manufacturing can be used mother lye obtained as a by-product from the recovery of sea salt in tropical or subtropical coast areas, such as Portugal or Spain.

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Sea salt is usually recovered in large open basins in which the sea water is introduced and subjected to sun radiation. In a first step, concentration occurs and then sodium chloride crystals are separated, while highly soluble potassium and magnesium salts and all the trace elements remain in solution. The evaporation proceeds as long as the sodium chloride crystals are sufficiently pure. When other salts than sodium chloride begin to crystallize, the evaporation is interrupted and the mother lye is returned to the sea as a waste product. This mother lye is especially suitable as a starting material for the process of the invention. A special advantage of the process is that a waste product, which is worthless per se, is utilized.

15 It has been shown that the content of the inorganic components of the sea water corresponds very closely to the content of the fluids in the human organism, except that the amount of sodium chloride is relatively much higher in sea water than in the organism. This is in accordance with the
20 fact that man's ancestors in early stages of the evolution were living in sea water and adapted their enzyme system to this environment.

The content of several elements in sea water compared to human cells is illustrated in the diagram of the accompanied drawing (ref: Sandoz Bulletin 51, 1979), where the abscissa represents the elements of the periodic system and the ordinate indicates the logarithm of the number of ions per nl for sea water and per cell for the organism.

It is seen that a surprising correlation exists between the relative concentrations of the two media. The biggest difference is that Na and Cl are found in substantial higher concentrations in sea water than in the organism. When a substantial part of the sodium chloride is removed from the sea water, a product is provided with almost the same composition as the fluid in the human cells.

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Due to the special composition of the mineral salt of the invention the risk of overdosing is reduced. When excess of sodium chloride is excreted through the kidneys, potassium, magnesium and all essential trace elements will 5 also be excreted, namely in the same relative proportions as they are added to the organism, so that neither a displacement of the electrolyte balance nor a depletion of the trace elements occur.

The use of the mineral salt of the invention is accordingly suitable for preventing all diseases which are caused by a wrong mineral balance due to excessive use of pure salt having a low content of other salts than sodium chloride.

The invention shall be illustrated by the following examples:

15 Example 1

As a raw material was used a saturated mineral salt solution produced by partial evaporation of sea water and removal of precipitated crystalline sodium chloride. The density of the solution was 1.21 and the content of dry material was about 30 weight%.

The solution was spray dried at a temperature of about 140°C . A fine crystalline freely flowing powder was produced the analysis of which was as follows:

25	Sodium	28 %
	Potassium	1,5 %
	Magnesium	5,3 %
	Lead	below 4 ppm
	Cadmium	" 0,4 ppm
	Mercury	" 0,02 ppm

The salt mixture can be used as a table salt.

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E x a m p l e 2

A mineral salt solution as described in example 1 was dried on a rotary drum at vacuum and the dried product was crushed to a coarse crystalline granulate, suitable as an 5 additive for nutrients.

E x a m p l e 3

A mineral salt solution as described in example 1 was mixed with the same amount of calcium carbonate and granulated and simultaneously dried. The granulate was compressed 10 on a tabletting machine to form tablets weighing 200 mg, suitable for oral administration as a disease preventing additive.

E x a m p l e 4

A mineral salt solution as described in example 1 was 15 introduced in gelatine capsules corresponding to 200 mg dry material per capsule. The capsules are suitable as a food additive for oral administration.

E x a m p l e 5

The mineral salt solution described in example 1 was 20 evaporated to half the volume and the precipitated crystalline sodium chloride was filtered off. 1,5 g of the mother lye was mixed with one litre of deionized water and the solution was saturated with carbon dioxide. The produced mineral beverage had an acceptable taste.

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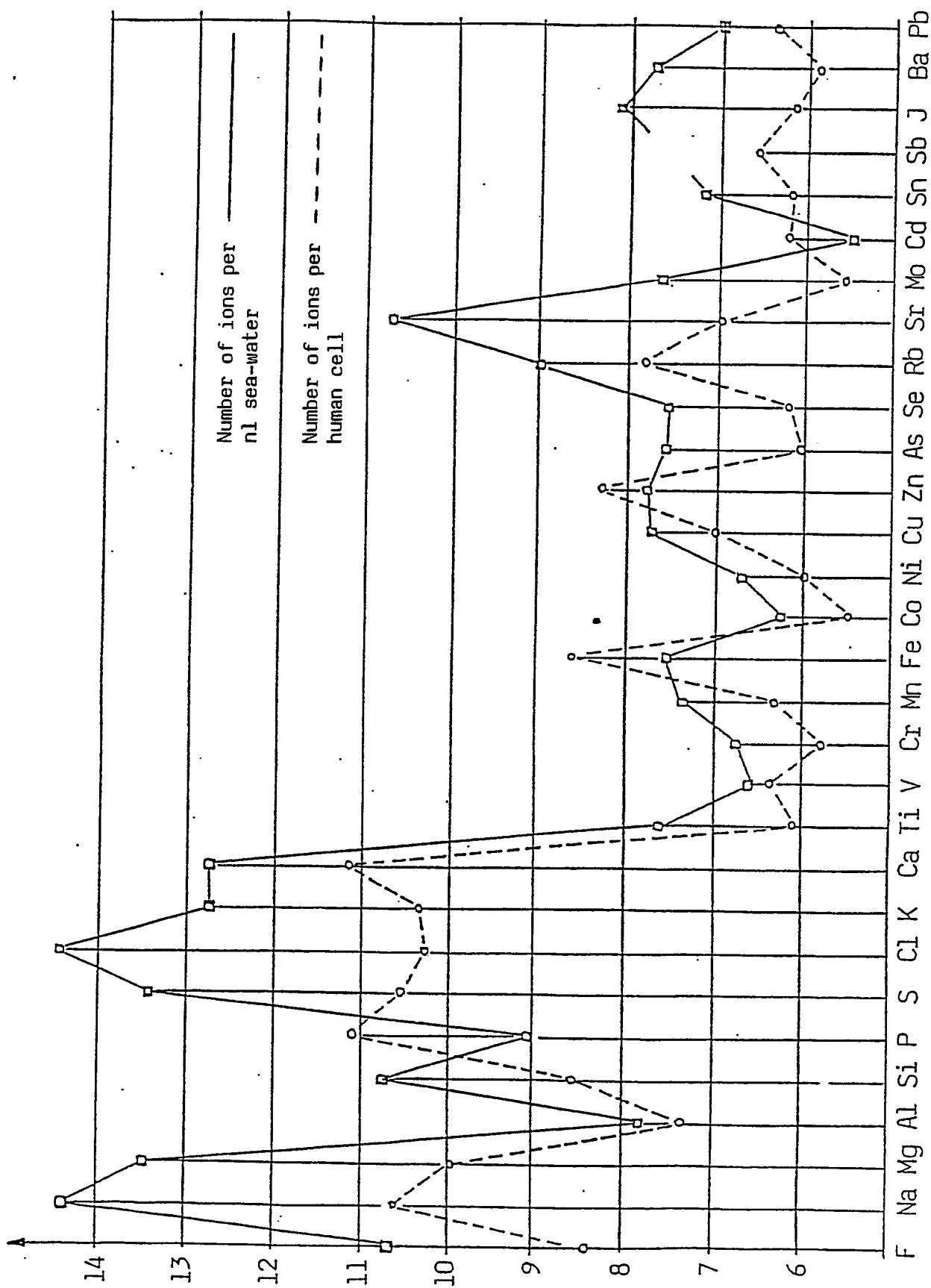
C L A I M S

1. Mineral salt composition for use as a food additive, a table salt or a medicament, characterized in that it contains soluble mineral salts in substantial the same proportions as occurring in sea water, except for a reduced content of sodium chloride.
2. Mineral salt composition in accordance with claim 1, characterized in that it is recovered from sea water by partial evaporation of the sea water, removal of a substantial amount of crystalline sodium chloride and evaporation of the mother lye.
3. Food additive, characterized in that it consists of the mineral salt mixture of claims 1 or 2.
4. Table salt, characterized in that it consists of a freely flowing powder or granulate having the composition as defined in claims 1 or 2.
5. Food additive in accordance with claim 3, characterized in that it consists of the mineral salt composition defined in claims 1 or 2, in the form of a tablet for oral administration and, if desired containing usual diluents and/or additives.
6. Medicament for prevention or treatment of deficiency diseases, characterized in that it contains the mineral salt mixture of claims 1 or 2.
7. Method of producing a mineral salt composition as defined in claims 1 or 2, characterized in that sea water is partially evaporated until a substantial amount of sodium chloride is precipitated, that the mother lye is isolated from the precipitated salt and, if desired, evaporated to a dry salt mixture.

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8. Method in accordance with claim 7, characterized in that sea water is evaporated to such an extent that the remaining mother lye, after removal of the precipitated crystalline sodium chloride, contains at least 1 weight percent potassium and at least 4 weight percent magnesium, based on dissolved dry substance, after which the mother lye is isolated and evaporated to form a dry crystalline powder.

9. Method in accordance with claims 7 or 8, characterized in that the remaining mother lye, after removal of precipitated crystalline sodium chloride, is subsequently dried in a spray drying apparatus or a drum dryer.



INTERNATIONAL SEARCH REPORT

International Application No

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I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC 4

A 23 L 1/304, 1/237, A 63 K 33/00

II. FIELDS SEARCHED

Minimum Documentation Searched ?

Classification System	Classification Symbols
IPC US Cl	A 23 L 1/22, /237, /30, /304; A 61 K 33/00, /14 424:153, 154; 426:648, 649

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched *

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT *

Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	DE, A1, 3 008 171 (W BRACHMANN) 10 September 1981 See page 6, line 30-page 7, line 4.	1-9
X	DE, A1, 3 201 405 (J A LINDON) 28 July 1983 See claims 1 and 6.	1-9
X	DE, B2, 2 060 601 (V BERTHELSEN INDUSTRIAL COMMERCIAL CO A/S) 16 March 1972 See claim 1 and column 1, line 66- column 2, line 14 & NL, 7111945 FR, 2107331 GB, 1298299 AT, 307620 AU, 32944/71 CA, 967052 BE, 772052 .../...	1-6

* Special categories of cited documents: ¹⁰

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IV. CERTIFICATION

Date of the Actual Completion of the International Search

Date of Mailing of this International Search Report

1986-06-19

1986-06-30

International Searching Authority

Signature of Authorized Officer

Swedish Patent Office

Inga-Karin Petersson
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category*	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
X	US, A, 4 107 346 (H L KRAVITZ) 15 August 1978 See claim 1	1-6
X	SE, B, 440 019 (CEDERROTH NORDIC AB) 25 August 1979 See page 2, lines 12-23 & BE, 874413 NL, 7901469 GB, 2015863 DE, 2906697 JP, 54126778 AU, 44402/79 FR, 2450568 CA, 1112173 SE, 7901586 AU, 529716 CH, 642827 SE, 8403228	1-6
P	WO, A1, 85/02324 (PHARMACONSULT OY) 6 June 1985	1-6